

THE ANATOMY OF THE INDIAN ELEPHANT. By
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PART I.—THE MUSCLES OF THE EXTREMITIES.

WHENEVER the comparative anatomy of mammalia shall be exhaustively treated, the structure of the existing species of elephants will claim a principal share of attention. They are so distinctly separated from other quadrupeds that an order is required for their sole reception. Yet, though isolated from all other existing species, they bear marks of affinity with more than one group, particularly with Ungulata, Sirenia, and Rodentia. This fact of recent zoology suggests a view which the history of extinct mammalia seems to justify, viz., that the elephants constitute a comparatively primitive type, representing, though perhaps not directly, a now extinct central group, from which the orders above mentioned, and possibly some others, may have been derived. The African and Indian elephants are further remarkable as the largest land quadrupeds now living; nor can the palæontologist, reviewing the land quadrupeds of all past times, so far as they are yet made known, find a trace of any larger form which is not also an elephant. Hence arise some curious physiological and mechanical questions to the student of elephant anatomy. What are the special modifications implied by a weight of perhaps three tons? How nearly do the existing species approach the limits of size fixed by mechanical laws and by the physical properties of animal tissues?

It would be an interesting task to investigate such problems as these, and to discuss the many points of anatomy, morphology, physiology, and palæontology suggested by the examination of a dead elephant. Our immediate purpose is less ambitious. Leaving the greater enterprise to other times, and probably to other hands, we here offer a condensed statement of facts respecting those parts of the structure of the elephant which are at

present least perfectly known. When the time for comparison and inference shall have come, such facts will be found of use.

For the convenience of future students, a list of the principal memoirs on the anatomy of the elephant is subjoined.¹ Some of these require special mention.

- ¹BLAIR, PATRICK.—The Anatomy and Osteology of an Elephant, being an exact Description of all the Bones of the Elephant which died near Dundee, April the 27th, 1706, with their several dimensions. *Phil. Trans.* vol. xxvii. p. 53, fig. (1710).
- On the Organ of Hearing in the Elephant. *Phil. Trans.* xxx. p. 885, fig. (1718).
- CAMPER, PIERRE.—Description Anatomique d'un Eléphant mâle. Publiée par son fils, A. G. Camper. Paris, fol. fig. (1802).
- Kort berigt van de ontleding eens jongen elephants. *Vaterlandsche letteroeffeningen* (1774). Translated in Camper's *Kleinere Schriften*, pt. i. p. 51, and *Euvres*, tom. i. and ii. p. 152.
- CORSE, JOHN.—Observations on the Different Species of Asiatic Elephants and their Mode of Dentition. *Phil. Trans.* vol. lxxxix. pp. 205–236, fig. (1799).
- CUVIER, GEORGES.—Recherches sur les Ossements Fossiles. Paris, 4th ed., tom. i. pp. 468–582, fig. (1834).
- CUVIER ET LAURILLARD.—Recueil de Planches de Myologie, tom. iii.
- DAUBENTON.—In Buffon's *Histoire Naturelle*, vol. xi. Paris, 4to (1764).
- GOODSIR, JOHN.—Notes on the Myology of the Elephant. Appendix to Anatomical Memoirs, vol. i. p. 446. Edinburgh, 8vo (1868).
- HARRISON, ROBERT.—On the Anatomy of the Elephant. *Proc. Irish Acad.* vol. iii. pp. 385–398 (1847).
- On the Larynx, Trachea, and Oesophagus of the Elephant. *Id.* vol. iv. pp. 132–135 (1850).
- On the Anatomy of the Lachrymal Apparatus of the Elephant. *Id.* vol. iv. pp. 158–165 (1850).
- HOME, EVERARD.—Some Observations on the Structure of the Teeth of Graminivorous Quadrupeds, particularly those of the Elephant and *Sus Æthiopicus*. *Phil. Trans.* vol. lxxxix. pp. 237–258, fig. (1799).
- HOUEL, J. P. L. L.—Histoire Naturelle des deux Éléphants, mâle et femelle, du Muséum de Paris. Paris, 4to, fig. (1803).
- [External parts only. These were the animals afterwards dissected by Cuvier.]
- HUNTER, JOHN.—Essays and Observations, edited by Prof. Owen, vol. ii. pp. 170–176, London, 8vo (1861).
- LEURET ET GRATIOLET.—Anatomie comparée du système nerveux. Paris, fol. fig. (1839–1857). [Brain.]
- MAYER, C.—Beiträge zur Anatomie des Elephanten und der übrigen Pachydermen.—*Akad. Ctes. Leop.* vol. xxii. 4to, fig. (1847).
- MOULINS, ALLEN.—Anatomical Account of an Elephant, accidentally burnt in Dublin, 4to, 72 pp. 2 pl. (1682).
- OWEN, RICHARD.—Description of the Fœtal Membranes and Placenta of the Elephant (*Elephas Indicus*, Cuv.), with remarks on the value of placental characters in the classification of the mammalia. *Phil. Trans.* cxlvii. pp. 347–353, pl. xvi. (1857).

Pierre Camper dissected an elephant in the winter of 1774. The work lasted less than three weeks. Camper had subsequently several opportunities of examining elephants of both sexes, and it was his intention to prepare a full anatomical description. He died, however, in 1789, leaving only the plates, an index to the figures, and the titles of the chapters which were to have composed the text. The published description, which is of some value, though by no means full, was drawn up by his son, A. G. Camper. The plates are free and tasteful, without much detail; they contain useful matter respecting the chief viscera, but only the most meagre notes of myology.

Hunter's notes are excellent, especially the account of the female generative organs.

Cuvier dissected a male elephant in 1805,¹ assisted by his pupils and by the painter Maréchal. He subsequently dissected two other specimens, a male and a female. The results appear in his posthumous *Recueil de Planches de Myologie*, published by Laurillard. The plates are not good. We find drawings only, without descriptive text, and the letters of designation are not always rightly affixed. Everywhere the want of the master's eye seems apparent. Though most of the details are correct, it is necessary to warn future students that hardly anything can be taken on trust from these plates. In the present memoir a systematic comparison with our own dissections has been made.

Mayer's dissection is given very briefly. Many of the muscles are merely named. We have found several mistakes of importance in this short account.

OWEN, R.—*Odontography*, pp. 625–655, pl. 146–150. London (1840–1845).

PERRAULT, CL.—*Mémoires de l'Académie Royale des Sciences*, tom. iii. part iii. p. 161, pl. xxiii. (1734).

——— Describes the African Elephant in *Mémoires pour servir à l'Histoire Naturelle des Animaux*, vol. ii. Amsterdam (1758).

SEBA, ALBERT.—*Locupletissimi rerum naturalium Thesauri accurata descriptio*, &c., vol. i. tab. iii. Amst. fol. (1734–1765). [Fœtus of Elephant.]

SERRAO.—*Opuscoli di vario Argomento*. Napoli, 4to, fig. (1766).

SPUKELEY.—*Essay towards the Anatomy of the Elephant* (1723).

——— *On the Spleen and Anatomy of an Elephant*. London, fol. (1733).

SUPPLY.—*Remarques anatomiques sur un éléphant ouvert au fort Saint-Georges* (1715).

TURNER, W.—*Lectures on the Comparative Anatomy of the Placenta*, 1st series, Edinburgh (1876). [Relates some Observations on the Structure of the Placenta in the Elephant.]

VULPIAN ET PHILIPPAUX.—*Notes sur le cœur, le foie et les poumons d'un éléphant (femelle)*. *Ann. Sci. Nat. Zoologie*, vol. v. (1856).

WATSON, MORRISON, M. D.—*Contributions to the Anatomy of the Indian Elephant*. *Journal of Anatomy and Physiology*, 1871–74. Observations in Human and Comparative Anatomy. Edinburgh (1874).

ZIMMERMANN, E. A. W.—*Beschreibung und Abbildung eines Neugebornen Elephanten*. Erlangen, 4to (1783).

¹ Deleuze, "History and Description of the Royal Museum of Natural History," *Eng. Trans.* vol. i. p. 91.

Vulpian and Philippaux give an excellent description of the heart, lungs, and liver. We have not thought it needful to describe these viscera afresh.

In 1856 the late Professor Goodsir purchased an Indian elephant, and dissected its fore and hind limbs, and the notes of his dissections, unfortunately very imperfect, are published in the Appendix to his *Anatomical Memoirs*, vol. i. p. 446. As the head and several of the viscera of this specimen had been preserved in spirit in the stores of the Anatomical Museum of the University of Edinburgh, Dr Morrison Watson was permitted by Professor Turner to examine them, and the results of his dissections were published in this *Journal*.

Our dissections, for the most part, agree closely with Dr Watson's, and had he been able to complete his researches in the same manner, our treatise would have proved superfluous.

A few words may usefully be said upon the mode of dissection. When this particularly awkward subject was offered to us we had no experience or instructions to guide us as to the best way of proceeding. We have, nevertheless, succeeded in preserving all the parts in a nearly unaltered state for three years without immersion in fluid. Any future dissector of a very large animal will do well to inject a preservative solution repeatedly before dismembering the carcass. Afterwards, it is merely necessary to keep the parts in a close-fitting box, lined with lead, and to wrap them in cloths wetted with dilute spirit, or other antiseptic. Occasional change of position is desirable.

Our example was a young female, about five feet high. It was purchased in December 1874 by the Council of the Leeds Philosophical and Literary Society, to whom our thanks are due, not only for permission to dissect the animal, but also for the readiness with which they have provided the appliances of all kinds necessary for such a piece of work.

MUSCLES OF THE FORE-LIMB.

Pectoralis major consists of two distinct portions. The superficial arises from the forepart of the sternum, and passes nearly transversely outwards, to be inserted about the middle of the shaft of the humerus. It is separated at its insertion by a small interval from the other part of the muscle. A few of the lowest fibres are continued into the fascia of the arm. *Pectoralis major* is overlaid by *masto-humeralis* and deltoid, with which some of its lower fibres are blended. The remaining portion of *pectoralis major* arises from the posterior two-thirds of the sternum, and passes forwards and outwards beneath the superficial part of the muscle, to be inserted into the humerus along the outer border of the bicipital groove, reaching upwards nearly to the apex of the greater tuberosity.

C. and L.¹—274-5, *j*; 283, figs. 1, 2, *j, j*¹; 284, fig. 1, *j, j* (should be *j*₁); 285-6, *j, j*₁; 287-8, *j, j*₁; 292-3, *j, j*² (should be *j*₁).

Pectoralis minor.—Cuvier and Laurillard figure (292-3, *j*⁸) a small muscle arising beneath the anterior portion of *pectoralis major*, and widening considerably towards its insertion into the upper end of the humerus. This is apparently the *pectoralis minor* of their index. We have not found this muscle.²

Serratus magnus arises by digitations from the 7th, 8th, 9th, and 10th ribs, and from the fascia above them. It is inserted into the inner surface of the apex of the scapula.

C. and L., 276-7 (*g*), 282, upper figure (*g*). Represented as arising from five posterior cervical vertebræ, as well as from ribs, 283, figs. 1, 2 (*g*).

Masto-humeralis arises by two distinct heads, the larger of which is attached by a strong rounded tendon to the basilar process of the occipital bone. The second and thinner head arises by a flat tendon from the mastoid process between the stylo-mastoid foramen and the origin of *digastricus*. It is inserted into the top and outer side of the tuberosity of the humerus, blending with the anterior part of the deltoid.

C. and L.—274-5 (*b*¹), "cleido-mastoidien ou trachélien;" 276-7 (*b*¹); 287-8 (*b*¹) (incorrectly shown as inserted into the first rib); 290-1 (*b*¹), 292-3 (*b*¹).

The plates indicate an insertion much lower down upon the humerus than that given above. We cannot reconcile the relations of *b*¹ to *k* (*masto-humeralis* to deltoid) in the different plates.

Deltoideus is comparatively thin. It arises from the under surface of a strong fascia, which is attached to the spine of the scapula, and stretches over the shoulder-joint. Part of the muscular fibres pass back to the angle formed by the spine and the unciform process. The remaining fibres arise from the fascia, along a line which extends from the tip of the unciform process to the posterior border of the scapula. The fascia is continued upwards and backwards over the *infraspinatus* to the borders of the fossa. The deltoid passes downwards, winding over the

¹ Cuvier and Laurillard, *Recueil de Planches de Myologie*.

² Our notes of the sterno-humeral muscles are, unfortunately, not quite complete, and certain details cannot now be recovered. The parts were cut through, when little beyond a *post-mortem* examination was thought possible.

tuberosity of the humerus, and is inserted into the outer and anterior surface of the humerus, immediately below the root of the tuberosity. Some of its fibres run into the *teres minor*, *q.v.*

C. and L.—274-5, *k*¹ (we have found nothing exactly corresponding to *k*); 276-7 (*k*¹); 283, fig. 1 (*k* ?); 284, fig. 1 (*k*¹); 292-3 (*k* ?).

Subscapularis arises from the whole internal surface of the scapula, except at the angles. *Serratus magnus* is inserted into the superior angle; *teres major* arises from the inferior angle; while above the glenoid cavity is a surface unoccupied by muscle, over which the *subscapularis* plays. This muscle takes origin also from the suprascapular ligament. It is inserted by a thin flat tendon into the internal surface of the head of the humerus close to the articulation. The insertion is overlaid by the *coraco-brachialis*.

C. and L.—283, figs. 1, 2 (*n*); 284, fig. 1 (*n*).

Supraspinatus.—A thick muscular mass, filling the supraspinous fossa, and taking origin also above from the fascia which covers the muscle. Inserted into the upper border of the tuberosity of the humerus. Fleshy throughout.

C. and L.—276-7; 283, figs. 1, 2; 284, fig. 1 (*l*).

Infraspinatus arises from the posterior surface of the spine of the scapula, and from the under surface of the unciform process. Its origin from the bone is defined below by a line drawn from the tuberosity of the humerus to the junction of the upper and middle thirds of the posterior border of the scapula. It arises also from the intermuscular septum between it and *teres minor*, and from the fascia which covers in the infraspinous fossa above the level of the unciform process. The muscle converges to a strong flat tendon, which is inserted into an oblique line along the outer surface of the base of the tuberosity of the humerus. Above this line a large and distinct bursa separates it from the tuberosity.

C. and L., 276-7 (*m*).

Teres minor arises from the outer surface of the scapula along the middle third of the posterior margin, and from the intermuscular septum beneath the muscle. It is inserted into the neck of the humerus behind and below *infraspinatus*, with the lower border of which some of its fibres are connected. Its tendon is

also closely connected with a very strong bundle of ligamentous fibres from the deep surface of the deltoid.

C. and L., 276-7 (*o*, the letter indicates *teres major*, according to the index).

Teres major arises from a small triangular surface on the internal aspect of the inferior angle of the scapula. It is inserted into the neck of the humerus along about two inches of a line connecting the inner side of the head of the humerus with the internal condyle. The lower fibres of the tendon are connected with part of *coraco-brachialis*. Immediately behind it is a bundle of muscular fibres, forming part of the *triceps*. The tendon of *teres major* is embraced by the two portions of the tendon of *latissimus dorsi*, of which the more superficial is inserted into the humerus a little above *teres major*, while the deeper and smaller portion is inserted immediately behind it.

C. and L.—283, figs. 1, 2 (*o*). In the second figure the origin would agree better with that of *teres minor*.

Coraco-brachialis arises thin and flat, by tendinous fibres from the tip of the coracoid tubercle, and from the upper part of the capsule of the shoulder-joint. It is inserted by fleshy fibres into the anterior surface of the humerus, between the insertion of *latissimus dorsi* and the internal condyle.

C. and L.—283, figs. 1, 2; 284, fig. 1 (*q*).

Biceps arises within the capsule of the shoulder-joint, from which it emerges as a strong round tendon. There is no trace of a coracoid head. The muscle gradually increases in thickness to the elbow-joint. Some of the deeper fibres are inserted into the anterior part of the capsular ligament, the rest pass over the joint to be inserted into the front and inner side of the ulna, close to its upper extremity. A large vein separates the insertion of the *biceps* from *brachialis anticus*.

C. and L.—283, figs. 1, 2 (*r*); 284, fig. 1 (*r*¹). The drawings are correct; but the index mentions a coracoid head which does not exist.

Brachialis anticus arises from the humerus just below the articular end, and external to the greater tuberosity. The muscle winds round the shaft of the bone to reach the front of the external condyloid ridge, from the commencement of which it receives some of its lower fibres. Inserted into the front of

the ulna, immediately below the *biceps*. The musculo-spiral nerve lies along its posterior border, while the *extensor carpi radialis longior* crosses it superficially. Beneath it lies a plexus of large veins, just above the elbow-joint, and a large horizontal branch of the brachial artery.

C. and L.—276–7 (s), 283, figs. 1, 2 (s); 284, figs. 1, 2 (s)?

Triceps.—The middle or long head (C. and L., 274–5, *t*, 276–7 *t*, 283 figs. 1, 2, *t*², origin only 284 fig. 1 *t*¹?), arises from the whole axillary border of the scapula by a thick and strong fleshy mass. It expands as it passes down, blends towards the elbow with the external head, and is inserted with it into the posterior surface of the end of the olecranon, lying superficially to the remainder of the muscle, from which it is separated indistinctly by connective tissue. The external head (C. and L., 274–5, *t*¹, 276–7, *t*¹), the stronger of the remaining two, arises from the posterior surface of the humerus, reaching as high as the greater tuberosity. It bridges over the musculo-spiral nerve just above the external condyloid ridge, and blends with the deeper surface of the middle head. The inner head (C. and L., 283, fig. 1, *t*³, 283, fig. 2, *t*) has a small pointed origin close below the insertion of *latissimus dorsi*. It passes downwards and widens out so as to occupy the whole posterior surface of the bone, between the condyloid ridges, a strong bundle taking origin from the external condyloid ridge. The inner head is inserted anterior to the rest of the muscle into the olecranon process.

Dorso-epitrochlearis.—A thin and flat muscle, which arises close to the posterior angle of the scapula on its ventral surface, and from aponeurotic fibres superficial to *triceps*. The lower part of the muscle is connected, close to its origin, with strong aponeurotic fibres derived partly from *latissimus dorsi*, partly from *panniculus*, and passing into the posterior border of the middle head of *triceps*. *Dorso-epitrochlearis* passes down as a thin flat muscle, extensively tendinous on its deeper surface, and is inserted by a small rounded tendon into the olecranon on its inner side, close to *triceps*, with which it partly blends.

C. and L., 283, fig. 1 (*t*), fig. 2 (*t* †).

Pronator radii teres.—A strong ligament, which may represent this muscle, springs from the inner side of the internal con-

dyle of the humerus, about on a level with *flexor carpi radialis*, but anterior to it. This ligament passes obliquely over the muscles and vessels, and is inserted into the middle of the radius for about two inches, expanding greatly over the bone. Beneath it, towards the radial extremity, are some muscular fibres, which spread out towards their insertion as a small triangular muscle, continuous with the ligament, and covered by it superficially.

C. and L., 283, figs. 1, 2 (*x*).

Flexor carpi radialis arises by a flat tendon from the back of the internal condyle of the humerus, passes directly along the inner side of the fore-arm, and ends in a round tendon, which occupies a distinct sheath connected with the annular ligament. The tendon is finally inserted rather deeply into the carpus. This muscle is remarkably elastic. When cut, it is retracted 3 inches, and is seen to be composed of regular alternate layers of muscular and elastic fibres in about equal proportions. The muscular fibres predominate towards the deeper surface, and also towards the origin of the muscle. This unexpected structural peculiarity would give rigidity to the limb, when it is extended in a perfectly straight line. When the animal stands, the toes are, so to speak, over-extended, so that the *flexor carpi radialis*, stretched like the chord across an arc, tends to draw the carpus upwards and forwards, and opposes the flexors. When, on the other hand, flexion has carried the limb in the least beyond the neutral line, the elastic band assists the flexors, drawing the carpus upwards and backwards.

C. and L.—283, figs. 1, 2 (*γ*); 284, fig. 2 (*γ*).

Elastic ligament of outer side of fore-arm.—Connected with the external condyle of the humerus is a very strong flattened band, composed partly of yellow elastic, but chiefly of white fibrous tissue. This passes down along the outer side of the fore-arm, and blends on its anterior and posterior borders with the strong fascia of that part of the limb. Opposite the upper fourth of the bones of the fore-arm, this ligamentous band spreads out laterally, becomes greatly thickened, and is converted almost wholly into yellow elastic tissue. It continues to widen as far as 2 inches above the lower end of the ulna, where it divides into two portions; of which the anterior and stronger is inserted into

the front of the end of the ulna, the posterior into the outer surface of the end of the same bone. The tendon of *extensor minimi digiti* separates the two portions. The insertion consists of white fibres chiefly.

Palmaris longus arises from the back of the internal condyle of the humerus, and from the strong intermuscular septa which divide it on the radial side from *flexor communis digitorum*, and on the ulnar side from *flexor carpi ulnaris*. *Palmaris* is a flat muscle, becoming tendinous at the commencement of the carpus, where it spreads out over the palm. The strongest portion of the tendon passes to the ulnar side, and is inserted into the sesamoid bone of the 5th digit. A median portion is much slighter, and is lost in the palm. On the radial side, part of the expansion blends with that of the extensor tendon. Lastly, a strong tendinous bundle of *palmaris* is attached by its deep surface to the annular ligament, nearly over the tendon of *flexor carpi radialis*, and superficial to the origin of *flexor brevis*.

C. and L.—283, figs. 1, 2 (α); 284, fig. 2 (α).

Flexor carpi ulnaris arises by two heads, one, thin and pointed, from the internal condyle, the common aponeurosis, and extensively from the intermuscular septum between this muscle and *flexor communis digitorum*. The second head, on the ulnar side, arises thick and fleshy from the back and inner side of the olecranon, immediately below the insertion of *triceps*. The ulnar nerve passes between the two heads of origin. The united muscle is inserted into the pisiform bone, and continued thence by strong fibres to the ulnar side of the manus.

C. and L.—274-5 (β); 276-7 (β); 283, figs. 1, 2 (β); 284, figs. 2, 4 (β).

Flexor communis digitorum arises by a common tendon with *palmaris* and *flexor carpi ulnaris* from the back of the internal condyle of the humerus. Its deep surface is tendinous, and separated by loose cellular tissue from the bones of the fore-arm. It ends in a very strong, flat tendon, which divides into five opposite the base of the radial sesamoid bone. Of these tendons, those to the 1st and 5th digits are only half the size of any of the others. The middle tendon is rather the strongest of the remaining three. Inserted as usual into the terminal phalanges. A small muscle, which may correspond to *flexor longus pollicis*,

arises, close to the common tendon, from the internal condyle of the humerus, but somewhat deeper. It lies beneath *flexor communis digitorum*, and to its radial side. At the lower fourth of the fore-arm it ends in a round tendon, which joins the deep surface of the common flexor. Another muscle arises by fleshy fibres from the ulna, beneath the ulnar origin of *flexor carpi ulnaris*, and to its inner side. It consists of a small conical bundle of muscular fibres, ending in a thin round tendon near the upper extremity of the fore-arm. The tendon joins the deep surface of the tendon of the common flexor on its ulnar side.

C. and L.—283, fig. 2 (μ , μ^1); 284, fig. 2 (μ^1 , μ , the letters of the preceding figure are reversed here, μ^2), fig. 4 (μ)

Flexor brevis digitorum arises from the annular ligament of the wrist, where it forms a sheath for *flexor carpi radialis*. It consists mainly of fleshy fibres. Opposite the base of the radial sesamoid it divides into two nearly equal masses, of which that to the radial side is inserted into the sheath of the long flexor tendon of the 4th digit. The short flexor crosses the other superficially, and is attached to its ulnar side. The second mass, shorter and smaller than the other, is similarly inserted into the flexor tendon of the 5th digit, blending also with the palmar fascia at its attachment to the sesamoid bone of the 5th digit.

C. and L.—283, fig. 2 (ξ); 284, figs. 2, 3, 4 (ξ).

Extensor carpi radialis longior (*supinator longus*?) arises chiefly from the lower part of the tendon of insertion of the deltoid on its outer side. It extends a little further upwards, and is connected with the lower and anterior border of the external head of the *triceps*. Between these points a thin slip arises from the humerus. The muscle passes down in its usual position, bridging over the *brachialis anticus*. It ends at the lower third of the fore-arm in a small tendon, which passes together with *extensor carpi radialis* beneath *extensor proprius pollicis*, then through a sheath upon the radius, having a separate compartment, but lying in the same groove with *extensor carpi radialis*. It lies rather deeper than that muscle, and to its inner side. It is inserted into the semilunar bone of the carpus.

C. and L.—274–5 (δ); 276–7 (δ); 283, figs. 1, 2 (δ); 284, fig. 1 (δ).

Extensor carpi radialis brevior arises from the front of the external condyloid ridge. It ends in a strong tendon which

passes beneath *extensor pollicis*, and has a distinct sheath upon the lower end of the radius; crosses the carpus, and is inserted principally into the base of the metacarpal of the 3d digit, and partly into the metacarpal of the 2d.

C. and L.—274-5 (δ^1); 276-7 (δ^1); 283, figs. 1, 2 (δ^1); 284, fig. 1 (δ^1).

Extensor communis digitorum arises by fleshy and tendinous fibres from the lower part of the external condyloid ridge, on the outer side of *extensor carpi radialis*, and also from the outer side of the external condyle, the two portions being indistinctly separated by a septum. The muscle passes down in a special sheath over the end of the radius, and becomes tendinous opposite the wrist-joint. The tendon spreads over the carpus, and is finally inserted into the upper surface of the 2d, 3d, 4th, and 5th digits. The divisions of the tendon of insertion form arches beneath which the vessels appear, as in the pes.

C. and L.—274-5 (ϵ); 276-7 (ϵ); 284, fig. 1 (ϵ).

Extensor minimi digiti arises by two heads—one muscular, and the stronger of the two, from the outer surface of the external condyle; the other, which is smaller and tendinous, from the front and outer side of the head and shaft of the ulna, and from an intermuscular septum between it and *extensor carpi ulnaris*. The muscle passes through a distinct sheath on the back of the ulna to the outer side of the manus, crossing the insertion of *extensor carpi ulnaris*, and is inserted into the base of the 5th digit. A tendinous expansion passes from the forepart of the tendon to the outer side of the base of the 1st phalanx of the 4th digit, and blends with the deep surface of *extensor communis*.

C. and L.—274-5 (ϵ^1); 276-7 (ϵ^1); 284, fig. 1 (ϵ^1). The additional slip of insertion is shown as passing to the 3d and not to the 4th digit.

Extensor carpi ulnaris, a strong muscle arising by a round tendon from the external condyle of the humerus, behind and a little above *extensor minimi digiti*. It lies along the outer surface of the ulna, passes through a distinct sheath on the outer side of the lower extremity of that bone, and is inserted by a strong round tendon into the metacarpal of the 5th digit.

C. and L.—274-5; 276-7; 284, fig. 2 (β^1).

Anconæus arises chiefly from the back of the external condyloid ridge; some of the upper fibres taking origin from the posterior border of the elastic ligament of the fore-arm, and some of the deeper fibres from the superior tendon of *extensor carpi ulnaris*. From this origin the muscle spreads out, and is inserted into a triangular surface on the outer side of the ulna, immediately beneath the olecranon. The apex of this triangle is situated nearly half way down the shaft. Below, the muscle is overlaid by *extensor carpi ulnaris*, and above by a dense fascia.

C. and L.—274-5; 276-7; 283, fig. 2; 284, fig. 2 (*u*).

Extensor pollicis arises from nearly the whole anterior surface of the radius, with the exception of a small part towards the lower end of the bone, from the interosseous membrane and from the adjacent surface of the ulna. At the lower part of the radius the muscle is twisted upon itself, so that the external fibres become anterior, and ultimately internal. The tendon passes through a special sheath on the inner side of the end of the radius, and is inserted into the base of the 1st digit. The tendon is connected by a lateral expansion with that of the *extensor indicis*. A large vein and the posterior interosseous nerve pass between the radial and ulnar origins of the muscle. Several large veins, communicating with the plexus in front of the elbow-joint, lie in the interosseous space beneath the muscle.

C. and L.—274-5; 276-7; 283, figs. 1, 2; 284, fig. 1 (*l*).

Extensor indicis.—Small and pointed above, where it arises from the front of the ulna close to the head of the radius, and below this from the intermuscular septum on the outer side between it and *extensor minimi digiti*, and on the inner side between it and *extensor pollicis*. The *extensor indicis* passes over the wrist in a separate synovial sheath, but in the same groove with *extensor communis digitorum*, and to its inner side. The tendon passes obliquely to the inner side of the manus, crossing the tendon of *extensor carpi radialis*. It then spreads out, and is inserted into the inner (radial) side and front surface of the 1st phalanx of the 2d digit. An expansion connects this tendon with that of *extensor pollicis*, close to their insertion.

C. and L.—274-5; 276-7; 284, fig. 1 (*e*²). Shown as connected with the inner side of the tendon of *extensor communis digitorum*, not with *extensor pollicis*.

Abductor minimi digiti arises from the annular ligament and pisiform bone. It is inserted into the sesamoid bone of the 5th digit to the ulnar side of *flexor brevis digitorum*.

C. and L.—283, fig. 2; 284, figs. 2, 3, 4 (v). In 283, fig. 2, a small muscle (“abductor”—adductor?—“minimi digiti”) is shown internal to the short flexor of the toes. We have not found this.

The *palmar fascia* consists of strong fibrous bands crossing in various directions, with large intermediate spaces filled with fat, especially between the digits. An exceedingly strong semi-circular band, concave towards the wrist, stretches across the heads of the metacarpal bones, and forms sheaths in the usual way for the flexor tendons. By dissection these sheaths can be resolved into a superficial or proper transverse ligament, and a deeper layer, which, when divided, presents on its deep surface two tendinous slips passing to be inserted into the base of the second phalanx on each side of the flexor tendon. This disposition resembles the ordinary arrangement of the *flexor sublimis*.

C. and L., 284, fig. 3.

Lumbricales arise all together from the superficial surface of the flexor tendon, just above its division. They are four in number, of which the 1st and 2d (from the radial side) are respectively inserted into the bases of the 1st and 2d digits on the ulnar side. The 3d lumbrical is inserted into the deep side of the sheath of the flexor of the 3d digit, and is continuous with one of the lateral tendinous bands of the flexor sheath. The 4th lumbrical passes deeply between the 3d and 4th digits, and is connected with an aponeurosis from the extensor tendon. The 1st and 2d *lumbricales* appear to have a similar attachment on the extensor side of the manus.

C. and L.—284, fig. 4. The 1st lumbrical is not seen in this drawing.

Flexor brevis pollicis.—The only short muscle of the first digit. Arises by a pointed origin from the os magnum, and is inserted into the sesamoid bone on the head of the first metacarpal. This muscle corresponds most nearly with the inner head of *flexor brevis pollicis*.

Not in C. and L.

Flexor brevis minimi digiti consists of two slips, which arise

from the unciform bone, and from a ligamentous band uniting the unciform and pisiform bones. The slips run side by side to their insertion into the ulnar side of the sesamoid on the head of the fifth metacarpal.

Not in C. and L.

Oppanens minimi digiti arises from a prominence upon the unciform bone, opposite the articulation of the fourth metacarpal, and is inserted into the radial side of the sesamoid of the fifth digit.

Not in C. and L.

Interossei (manus).—There are three palmar *interossei*, which arise near together from the carpus, opposite the articulation of the third metacarpal. They diverge to be inserted—the first into the expansion of the *extensor communis digitorum* on the ulnar side of the second digit; the other two in the same manner, but on the radial sides of the fourth and fifth digits. The insertion corresponds, therefore, with that in the human subject. The dorsal *interossei* are also three in number, and form short, thick muscles. That of the index digit consists of two distinct portions, one arising from the base of the first metacarpal and the adjacent surface of the trapezium; the other from the base of the second metacarpal. They are inserted together into the sesamoid of the index. The *interosseus* of the third digit arises from the base of the third metacarpal, and is inserted like the preceding. The *interosseus* of the fourth digit is quite similar to that of the third. Each of the dorsal *interossei* shows a distinct separation into lateral halves, one to each division of the sesamoid. The *interossei* are invisible from the dorsal side of the manus.

Not in C. and L.

Of the foot as a whole, and this remark applies to both fore and hind extremities, the separate mobility of the parts is greater than would be suspected from an external inspection, and much greater than in most Ungulates. The palmar and plantar soles, though thick and tough, are not rigid boxes like hoofs, but may be made to bend even by human fingers. The large development of muscles acting upon the carpus and tarsus, and the separate existence of flexors and extensors of individual digits, is further proof that the elephant's foot is far from being a solid,

unalterable mass. There are, as has been pointed out, tendinous or ligamentous attachments which restrain the independent action of some of these muscles; but anatomical examination would lead us to suppose that the living animal could, at all events, accurately direct any part of the circumference of the foot by itself to the ground.

The metacarpal and metatarsal bones form a considerable angle with the surface of the sole; while the digits, when supporting the weight of the body, are nearly horizontal.

MUSCLES OF THE HIND LIMB.

Psoas magnus arises chiefly from the sides of the bodies of the four lower dorsal vertebræ. It receives slips from the 15th, 16th, 17th, 18th, and 19th ribs. Inserted, together with *iliacus*, into the inner side of the femur below the neck of the bone. Another slip arises from the brim of the pelvis and the capsular ligament, passing to the front of the femur, 3 inches below the capsular ligament.

C. and L., 290-1, *h*.

Psoas parvus arises from the sides of the bodies of the lumbar vertebræ, internal to *psoas magnus*. It ends in a tendon about 4 inches long, which is inserted into the brim of the pelvis for about the middle third of the lateral margin. The external iliac vessels lie adjacent to the inner side of this muscle.

C. and L., 290-1, *g*.

Iliacus arises from the whole of the iliac fossa, except a small space adjacent to the brim of the pelvis, over which *psoas magnus* passes. It is inserted together with that muscle. The anterior crural nerve emerges between *psoas* and *iliacus* in the usual position.

C. and L.—290-1, *i*; 292-3, *i*; 294, fig. 1, *i*. In 290-1 the muscle is shown as a rounded tapering mass, lying upon the inferior surface of the ilium, and projecting considerably from it. The full width of the muscle (which occupies the whole of the ilium) and its conformity to the curves of the iliac fossa do not appear in the drawing.

Tensor fasciæ femoris, a thick strong muscle, arises from the outer surface of the anterior spine of the ilium, and from the

Bone immediately adjacent. It passes downwards on the outer side of the thigh, and is lost in the fascia at the junction of the lower third with the remainder of the thigh. Here it is closely united with the anterior fibres of *glutæus maximus*.

C. and L.—274-5 *x*, 276-7, 287-8, 290-1, 292-3; 294, fig. 1 *x*. Omitted by Mayer.

Gracilis arises by a very thin flat tendon from the posterior three-fourths of the middle line of the pubic symphysis. The tendon has a straight anterior border, and terminates about half-way between the origin and insertion, where muscular fibres take its place. On the posterior border the muscular fibres run up to the origin. Most of the fibres pass backwards and downwards, and are inserted into the fascia of the thigh. The anterior fibres, which form a separable band about two inches wide, are inserted into the inner side of the tibia, an inch and a half below the tuberosity.

C. and L.—285-6 *u*. In this drawing the posterior margin is too distinct, and the muscle far too rounded and solid. 290-1; 292-3; 294, fig. 2 *u*.

Sartorius.—A broad, flat muscle, which arises from the fascia on the front and inner part of the thigh below Poupart's ligament. The muscle consists of loosely coherent muscular bundles which thin out below. The most prolonged are inserted by several tendinous strings into the thick yellow fascia of the leg immediately below the knee-joint on its inner side.

Not figured by Cuvier and Laurillard.

Glutæus maximus occupies, superficially, the inner two-thirds of the buttock. It is sheathed in fascia, which, on the outer side of the muscle, is strengthened by a considerable thickness of yellow elastic tissue, but thins away internally. The muscle arises from the crest of the ilium by means of a thin fascia, from the dense fascia which covers *glutæus medius*, from the side of the sacrum and upper caudal vertebrae, and from the great sacro-sciatic ligament. The fibres are inserted as follows:—The anterior or external part into the upper part of the fascia lata, the internal fibres into the inner edge of the same, while a strong bundle of the deep inner fibres passes to the middle fifth of the femur.

C. and L.—274-5; 276-7; 287-8; 294, fig. 2 (*a*, *g* part).

We cannot understand Pl. 294, fig. 2. The foreshortening is probably wrong. What are described above as the internal fibres of *glutæus maximus*, Cuvier and Laurillard call *biceps*, while the deep inner fibres correspond to their "*biceps*—portion fémorale." Mayer assigns to *glutæus maximus* an insertion into the great trochanter; he speaks further of its tendon as blending with a portion of the "caput breve des M. occipitis."

Glutæus medius arises from the side of the upper part of the sacrum beneath *glutæus maximus*, from the upper half of the back of the ilium, from the dense fascia covering the muscle, and from the lower and anterior part of the crest of the ilium as far as the anterior spine. It is separated from *glutæus minimus* by vessels, and the superior gluteal nerve. From this origin the fibres converge and are inserted as follows:—The anterior two-thirds into a line which extends obliquely downwards and forwards from the superior and posterior part of the great trochanter, the posterior third into the apex of the trochanter and into a ligament which passes thence to the acetabulum. The most posterior fibres pass down to the posterior root of the trochanter about 8 inches from its apex.

C. and L.—276-7; 287-8; 294 (a^1).

Glutæus minimus arises from the middle third of the back of the ilium beneath *glutæus medius*. The fibres converge to a small tendon which is inserted into a depression on the outer aspect of the root of the trochanter.

C. and L.—287-8 (a_2); 294, fig. 1 (a_2). The f of the last-mentioned figures, "pyramidal (sacro-trochantérien)," we have not found as a separate muscle. In the absence of a_2 this would agree with our *G. minimus*.

Biceps femoris arises by a thin round tendon from the tuberosity of the ischium beneath and external to the other hamstring muscles. It is narrow above, but widens greatly below. The more anterior fibres are continuous with the lower fibres of *glutæus maximus*, and are inserted into the outer side of the femur for several inches above the knee. A separable strap-like bundle of the most posterior fibres proceeds from the belly of the biceps to the fascia of the leg. The peroneal nerve separates the anterior from the posterior division of the muscle.

C. and L. (*biceps*—portion fémorale).—274-5; 276-7; 287-8;

294, fig. 2 (part of *g*, and in 294, fig. 2 *g*). The biceps of Cuvier and Laurillard includes also what we have described as the posterior part of *glutæus maximus*.

A strong band of fascia is continued from the back of the leg to the calcaneum; *biceps* passes into the oblique upper edge of this fascia, and the tendon of *gastrocnemius externus* blends with its deep surface.

Semitendinosus arises by fleshy fibres from the ramus of the ischium, and ends about the middle of the thigh in a thin tendon, which is lost in the fascia of the inner and back part of the thigh.

C. and L.—274-5; 285-6; 287-8; 289, figs. 1, 3, 4; 294 (*r*). Drawn as passing to the inner side of the tibia, and ending in a distinct tendon.

Semi-membranosus arises by a double tendon. The external head, long, round, and slender, is attached to the great sacro-sciatic ligament and the side of the sacrum. The other, square in section, and tendinous upon its deep surface, springs from the tuberosity of the ischium. The muscle ends in a flattened tendon about three inches below the knee-joint. This tendon divides into two parts, of which the anterior, broad and flat, is inserted into the anterior and internal surface of the tibia, about the middle of the bone; the posterior portion is continued to the internal malleolus, and is connected along its posterior border with the deep fascia of the leg.

C. and L.—274-5; 285-6; 287-8; 289, fig. 4; 294 (*s*).

Obturator externus arises from the outer surface of the obturator membrane, and from the bone beneath. It is inserted into the digital fossa of the femur, anterior to *obturator internus*, and somewhat below it.

Not given in Cuvier and Laurillard.

Obturator internus arises from the inner margin of the obturator foramen, and is inserted into the digital fossa, posterior to *obturator externus*, and by a narrower tendon.

Not given in Cuvier and Laurillard.

Adductor magnus takes origin from the os pubis and ramus of the ischium. It is inserted into the back and inner side of the femur for about the middle two-thirds of its length, and by a separate slip into the internal condyle of the same bone.

Adductor magnus is pierced, as usual, by the femoral vessels, which intervene between the main part of the muscle and the slip which passes to the internal condyle. It is pierced also by the obturator nerve.

C. and L.—285-6 (l); 289, figs. 3, 4 (l); 290-1 (l, l¹); 292-3 (l).

Adductor longus is closely connected above with *pectineus*, but has a distinct rounded tendon of origin, attached to the front of the pubes beneath *pectineus*, and nearer to the symphysis. *Adductor longus* is inserted into the inner side of the femur, reaching to a point just above the internal condyle.

C. and L.—("2^e Pectiné"), 290-1; 292-3 (k¹).

Adductor minimus. This large and distinct quadrilateral muscle arises from the ramus of the ischium, beneath the hamstring muscles, and is inserted into the posterior surface of the femur for about the second fourth of the bone, counting from above. Towards its insertion it is partly enveloped by *adductor magnus*, a large vein separating the two muscles. Their fibres ultimately unite, and are inserted together.

C. and L., 290-1 (d?).

Pectineus takes origin between the iliopectineal eminence and the symphysis pubis. Some of its fibres are closely connected with the tendon of origin of *adductor longus*. It is inserted into the middle of the femur on its inner side, above and external to *adductor longus*.

C. and L.—285-6; 290-1; 292-3 (k).

Gastrocnemius externus arises by a small round tendon from the external condyle of the femur in front of *plantaris* and external to it; also from the intermuscular septum between it and the *peronæi*. It is a thin, flat muscle, ending by a tendon in the deep surface of the common tendon of the os calcis.

C. and L.—("Plantaire grêle"), 276-7, 285-6, 287-8, 289, figs. 3, 4 (γ). Mayer's figure of the *gastrocnemii* (*Act. Acad. Cæs. Leop.* vol. xxii. t. ix. fig. 4), is very indistinct and not accurate.

Gastrocnemius internus takes origin as a thin flat muscle from the internal condyle of the femur, and partly from the capsule of the knee-joint. It passes downwards and outwards, ending a little below the middle of the leg in a small flattened tendon. The lower four inches are sheathed in a strong aponeurosis

derived chiefly from *biceps femoris*. *Gastrocnemius externus* and *internus*, *semimembranosus*, *semitendinosus*, and the aponeurosis from *biceps femoris* unite to form the common tendon of the os calcis.

C. and L.—276-7; 285-6; 289, figs. 3, 4; 292-3 (α).

Popliteus arises by a round tendon from the external condyle of the femur, beneath the external lateral ligament. The muscle occupies a deep groove, lined with cartilage and synovial membrane, which lies obliquely above the head of the fibula, and is inserted into a triangular surface of considerable extent on the posterior aspect of the upper half of the tibia. Below and to its outer side, *popliteus* is bounded by a strong ligamentous band, which stretches from the tibia to the head of the fibula. Part of the muscle is inserted into the deep surface of this band.

C. and L., 289, fig. 4 (v).

Plantaris arises from the posterior surface of the external condyle of the femur by a roundish mass of muscular fibres. About the junction of the upper and middle thirds of the leg it passes into a tendon, very similar to that of *gastrocnemius internus*, but more slender. It passes beneath that muscle towards the middle of the leg, and receives an investment from the fascia. On reaching the os calcis, *plantaris* spreads out into a thin fascia, separated from the heel by a bursa. Externally, it is connected with a strong annular ligament which surrounds the tarsus. *Plantaris* is finally inserted into the plantar fascia, *q.v.*

C. and L. ("Gastrocnemien externe").—274-5; 276-7; 285-6; 287-8; 289, figs. 3, 4 (α).

Soleus arises by a thin, flat tendon from the posterior and external surface of the head of the fibula, and from the intermuscular septum between it and the *peronæi*. It is inserted by fleshy fibres into the upper part of the tuberosity of the os calcis, beneath the common tendon, but closely blended with it. *Soleus* is channelled by several large veins, which course longitudinally through it.

C. and L.—274-5; 276-7; 287-8; 289, figs. 3, 4; 292-3 (β).

Peronæus longus arises from the head of the tibia, and from strong fibres which pass over the capsule of the knee-joint. It

becomes tendinous, and passes down in a groove behind the external malleolus, external to *peronæus brevis*. The muscle winds round the outer edge of the foot, to be inserted deeply, beneath the calcaneo-cuboid ligament, into the posterior border of the cuboid. A small part of the tendon passes further into the sole, towards the bases of the metatarsals.

C. and L.—274-5; 276-7; 287-8; 289, figs. 1, 2, 3, 4 (ϵ). Mayer states (incorrectly), that *peronæus longus* is pierced by the peroneal nerve.

Peronæus brevis arises from nearly the whole of the outer surface of the fibula. It becomes tendinous along its anterior border immediately above the external malleolus; but the muscular fibres are prolonged nearly to the insertion along the posterior border. The tendon lies in the groove behind the external malleolus, and is separated from that of *peronæus longus* by a division of the external annular ligament. It then crosses the base of the 5th metatarsal, and is inserted principally into the fibular side of the metatarsal of the 4th digit; also, by a small slip, into the proximal phalanx of the 5th. *Peronæus brevis* underlies *P. longus*, and is much broader than that muscle. The peroneal nerve passes between them.

C. and L.—274-5, but incorrectly drawn and not lettered; ϵ^1 is put upon another muscle; 276-7 (ϵ^1); 287-8 (ϵ^1); 289, fig 3 (ϵ^1), figs. 1, 2, 4, not lettered; ϵ^1 of these figures is our *P. anticus*.

Peronæus anticus arises by a round tendon from the external lateral ligament of the knee, and by a second head from the top of the tibia and lower two-thirds of the front of the fibula, adjacent to the tibia. It divides into two main slips. The more superficial passes outwards, and is inserted into the outer border of the 5th metatarsal. The deeper portion is subdivided into two parts, of which the shorter passes to the 4th and 5th metatarsals; the longer to the fibular side of the 4th. A slip from the anterior border of the external malleolus blends with the muscle. This accessory slip would agree with *P. tertius*.

C. and L.—274-5 (ϵ_1 , ϵ_2); 276-7 (ϵ_2); 287-8 (+ ϵ_1 , accessory slip); 289, fig. 1 (ϵ_1); fig. 2 (ϵ_1 + ϵ); fig. 4 (+ ϵ_1 , accessory slip). Not in Mayer.

Rectus femoris arises partly from the notch between the

anterior spine of the ilium and the border of the acetabulum. The tendon of attachment arches over the centre of the concavity. Between it and the bone is a large branch of the external iliac artery, and a considerable venous anastomosis. The external head arises from the root of the great trochanter on its anterior surface, and extensively from an intermuscular septum between this muscle and *vastus externus*. The long head is inserted into the front of the patella; the external head has a slightly distinct insertion above, and to the outer side of the other.

C. and L.—285-6 (*p*); 287-8 (*p*); 290-1 (*p*); 292-3 (*p*); 294, fig. 1 (*p*; *m*, and *o* perhaps represent the external head).

Vastus internus arises from the lower half of the femur on its inner surface. It becomes very thick and fleshy in its lower part, and is inserted into the inner border of the patella and the ligamentum patellæ.

C. and L.—285-6 (*n*); 290-1 (*n*); 292-3 (*n*); 294, fig. 1 (*n*).

Vastus externus arises from the outer surface of the trochanter, and from nearly the whole length of the femur along its outer border. The line of origin then curves out towards the external condyle. The muscle is inserted, chiefly by fleshy fibres, into the outer side of the patella, into the ligamentum patellæ, and the aponeurosis of the leg.

C. and L.—276-7 (the right-hand *m*); 287-8 (*m*); 289, fig. 2 (*m*); 290-1 (*m*); 294, fig. 1 (*m*).

Crureus arises from nearly the whole anterior surface of the femur, and from the lower part of the external surface of the trochanter. It sends processes of attachment between the adjacent muscles, thus embracing by pointed slips the femoral origin of *rectus*, and the insertion of *glutæus minimus*. It is inserted into the upper border of the patella. This muscle is much divided by vessels and tendinous septa.

C. and L.—290-1 (*o*); 294, fig. 1 (*o*). Mayer appears to consider this muscle a part of *vastus externus*.

Tibialis anticus is the most internal of three muscles which occupy the front of the leg, and which are hardly separable above. It arises from the external surface of the tibia, for the middle three-fifths of the length of the bone, passing downwards

and slightly inwards to its insertion into the metatarsal of the 2d digit. It crosses the tendon of *tibialis posticus*, close to its insertion. *Tibialis anticus* is fleshy almost to its termination.

C. and L.—285-6 (♂); 287-8 (♂); 289, figs. 1, 2 (♂); 292-3. Mayer states that this muscle is inserted into the cuboid and 1st and 2d metatarsals.

Extensor communis digitorum arises from the tibia, external to *tibialis anticus*, for nearly the whole length of the bone; also from the intermuscular septum on its outer side. Passing downwards, it spreads out, and becomes tendinous over the tibio-tarsal articulation. It finally divides into four slips, which are inserted into the upper surface of the digits. The tendons to the third and fourth toes are much stronger than the rest. That to the fourth gives off a slip to the base of the proximal phalanx, an arrangement which does not exist in the other tendons.

C. and L.—274-5 (♂); 276-7 (♂); 285-6 (♂); 287-8 (♂); 289, figs. 1, 2 (♂); 292-3 (♂). The slips appear more distinct from each other in the drawings than in our dissections.

Extensor brevis digitorum has an oblique origin from the dorsum of the tarsus, following a line drawn to connect the external malleolus with the base of the second metatarsal. The dorsal vessels pass between the two main divisions of the muscle, close to its origin. The outermost and highest head of *extensor brevis* is partly concealed by a strong ligamentous band connected with the external lateral ligament. Opposite the heads of the metatarsal bones the muscle blends with the under surface of the tendinous expansion of *extensor communis digitorum*, but the deeper fibres pass into a strong ligament which encloses the heads of the metatarsals and the bases of the first phalanges. No part of the muscle is attached to the first or second digits.

C. and L.—276-7 (♂); 287-8 (♂); 289, figs. 1, 2 (♂); 292-3 (♂). Mayer's brief account is very inaccurate.

Tibialis posticus is concealed beneath *flexor longus digitorum*. It arises from the posterior surface of the tibia, below what answers to the oblique line; from the adjacent surface of the fibula; and largely from the intermuscular septum between this muscle and *flexor longus digitorum*. It ends in a tendon, which

passes through a distinct sheath on the inner malleolus, and is inserted into the upper surface of the bases of the second and third metatarsals, being crossed, immediately above its insertion, by *tibialis anticus*.

C. and L.—289, fig. 4 (δ^1); 292–3 (δ^1). Mayer's description is very incorrect; the muscle is said to pass over the outer malleolus, and to blend with *tibialis anticus*.

Flexor communis digitorum arises by tendinous and fleshy fibres from the postero-internal surface of the head of the fibula. An additional slip, small and tendinous, proceeds from the tibia, internal to the insertion of *popliteus*, from the oblique ligament between the tibia and fibula, and from the septum between *flexor communis* and *tibialis posticus*. The muscle becomes tendinous opposite the tuberosity of the os calcis, and passes into the sole along a groove at the junction of the astragalus with the sustentaculum tali. *Flexor longus hallucis*, a larger muscle than the last, arises from the posterior and internal surfaces of the fibula, and from the septum between the two muscles. It passes through a distinct sheath. Opposite the ento-cuneiform bone *flexor digitorum*, which lies superficial to the other, spreads out, and blends by its deep surface with the tendon of *flexor hallucis*. The separate flexor tendons are given off after this junction. The small tendon to the first digit, and that to the fifth, are furnished almost entirely by *flexor digitorum*, while those to the middle digits proceed from the two flexors jointly. There is no trace of a short *flexor digitorum*, unless the *lumbricales* from *plantaris* represent it. In the flexor sheaths there is on each side a strong band, which passes to the second phalanx, and the two bands enclose the tendon, very much as the *perforatus* usually encloses the *perforans*. In the case of the third digit, a lumbrical muscle is distinctly inserted into one of these bands.

C. and L.—285–6 (ι); 289, fig. 3 (ι), 4 (ι). In this figure the tendon is not correctly drawn—292–3 (ι_1). The above refer to *flexor communis digitorum*; *flexor longus hallucis* is shown in 289, fig. 3 (ι_1), fig. 4 (ι); 292–3 (ι).

The plantar fascia is exceedingly strong on the outer side of the foot, forming a sheath for the short muscles of the fifth digit. In front, it is firmly connected with a strong transverse

band, which stretches across the sole over the heads of the metatarsal bones. The fascia is not so strong on the inner side of the foot; here it blends with the other connective tissues of the sole. Close to the inner side of the tuberosity of the heel, a rather strong tendinous portion of *plantaris* passes deeply. The first *lumbricalis* is attached to this; beyond, the tendinous slip gives off a bundle of fibres to the deep flexor tendon, and itself ends in a small round tendon, from which the third and fourth *lumbricales* take origin.

The general disposition of the superficial ligaments of the sole is similar to that of the fore-limb. A synovial bursa and a great quantity of highly elastic connective tissue in each case separates the ligamentous from the horny sole.

Lumbricales.—The first, short and much stronger than the rest, arises from the tendon of *plantaris* on its inner side, close to the tuberosity of the os calcis. It is inserted by a flattened tendon into the tibial side of the first phalanx of the first toe. The tendon of *plantaris*, prolonged towards the middle digit, gives off next, on the inner side, the second lumbrical, which passes to the flexor sheath of the second toe. On the other side two *lumbricales* arise, close together, from the tendon of *plantaris*. One passes to the sheath of the flexor tendon of the third digit, the other similarly to that of the fourth. The *lumbricalis* of the third digit arises also by a small head from the deep flexor just above its division. Another lumbrical, given off at the same point, is inserted into the tibial side of the sheath of the third digit, and is connected further with the extensor tendon. A shorter and thicker lumbrical arises from the flexor tendon just behind the preceding, and passes to the tibial side of the second digit, where it is attached, like the rest, to the deep surface of the sheath. There is no *lumbricalis* of the fifth digit.

C. and L.—289, figs. 4, 5 (λ); 292–3 (κ).

We have not found the muscle named extensor of the metacarpus, and lettered + ζ by Cuvier and Laurillard.

Abductor minimi digiti (pedis).—A short, thick muscle, arising from the under surface of the tuberosity of the os calcis, and inserted by means of a sesamoid into the proximal phalanx of the fifth digit.

Not in C. and L.

Adductor minimi digiti.—A smaller muscle than the last. Arises from under surface of os calcis, in front and to the inner side of the *abductor*; also from calcaneo-cuboid ligament. Inserted into the sesamoid just mentioned to the inner side of the *abductor*.

Not in C. and L.

Flexor brevis hallucis.—A small, short muscle, arising from the sustentaculum of the os calcis, beneath a strong ligamentous band which stretches across the centre of the tarsus.

Not in C. and L.

Interossei (pedis).—Only a single plantar *interosseus* can be distinguished. It arises from the tarsus, opposite the bases of the third and fourth metatarsals, and is inserted into the fibular side of the base of the second digit. The second, third, and fourth digits are provided with dorsal *interossei*, almost exactly resembling those of the manus.

Not in C. and L.